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APPENDIX C

SAMPLING AND ANALYSIS PLAN

AR300895

## TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION .....	1-1
1.1 Objectives .....	1-1
1.2 Overview of Sampling and Analysis Plans .....	1-1
1.3 Types, Location, and Number of Samples and Field Measurements .....	1-2
2.0 SOIL SAMPLING PLAN .....	2-1
2.1 Objectives and Rationale .....	2-1
2.2 Phase I - Soil Sampling Method and Sampling Techniques .....	2-2
2.3 Phase II - Soil Sampling .....	2-4
3.0 SURFACE WATER AND SEDIMENT SAMPLING PLAN .....	3-1
3.1 Objectives and Rationale .....	3-1
3.2 Surface Water and Sediment Sampling .....	3-1
4.0 GROUND WATER SAMPLING PLAN .....	4-1
4.1 Objectives and Rationale .....	4-1
4.2 Evaluation of Existing Site Monitoring Wells .	4-2
4.3 Sampling On-Site Residential Wells .....	4-3
4.4 Site Selection of Final Well Locations .....	4-4
4.5 Well Construction, Installation, and Sampling.	4-5
4.6 Hydrogeological Techniques .....	4-12
4.7 Data Reporting .....	4-14
5.0 BIOASSESSMENT STUDY .....	5-1
5.1 Objectives and Rationale .....	5-1
5.2 River and Stream Samples .....	5-1
6.0 REPORTING AND SCHEDULING .....	6-1
6.1 Field Data Reports .....	6-1
6.2 Project Scheduling .....	6-2

AR300896

BROWN'S BATTERY BREAKING SITE

Section: Table of Contents  
Revision No: 0  
Date: 15 May 1989  
Page: 2 of 3

TABLE OF CONTENTS  
(Continued)

	<u>Page</u>
7.0 SITE MANAGEMENT .....	7-1
7.1 Equipment Calibration, Operation and Maintenance .....	7-1
7.2 Sample Equipment Decontamination Procedures ..	7-1
7.3 Survey of Site Sampling Points .....	7-2
7.4 Containerization and Analysis of Investigation-Derived Wastes .....	7-2
8.0 REFERENCES .....	8-1

AR300897

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
1-1	Summary of Surface Water Samples .....	1-3
1-2	Summary of Sediment Samples .....	1-5
1-3	Summary of Soil Samples .....	1-7
1-4	Summary of Ground Water Samples .....	1-9
1-5	Sample Volumes, Preservatives, Containers and Holding Times .....	1-10
4-1	Proposed Monitoring Well Depths and Zones Monitored .....	4-4
5-1	Endangered or Threatened Species of Snails and Clams in the Study Area .....	5-2

## LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1-1	Approximate Surface Water and Sediment Sample Locations .....	1-16
1-2	Approximate Soil Sample Locations .....	1-17
1-3	Proposed Monitoring Well Locations .....	1-18
1-4	Approximate <u>Corbicula</u> sp. Sample Locations .....	1-19
4-1	Monitoring Well Schematic .....	4-6
4-2	Standard Well Log .....	4-14
6-1	Remedial Investigation/Feasibility Study Schedule .....	6-3

AR300898

## 1.0 INTRODUCTION

The following seven sections outline the specific field sampling protocols which will be followed and the samples which will be taken during the Remedial Investigation/Feasibility Study (RI/FS) at the Brown's Battery Breaking Site. This plan will be implemented in conjunction with the protocols set forth in the Quality Assurance Project Plan (QAPjP) and Health and Safety Plan (HSP) for this site. For a detailed description of the site and its history, the reader should consult the RI/FS Work Plan or QAPjP. Section 8 contains a list of references which were used in the preparation of this document.

### 1.1 OBJECTIVES

The overall objective for field sampling at the Brown's Battery Breaking Site is to collect environmental samples which are representative of the sites and matrices being studied and to handle these samples in a manner which ensures their safe, predictable, and timely delivery to the laboratory for analysis. In addition, all samples collected from this site must be able to withstand judicial scrutiny. It is the responsibility of the Quality Assurance Officer (QAO) or Project Manager (PM) to ensure that all samples taken on this site comply with methods outlined in the Sampling and Analysis Plan (SAP) and QAPjP.

### 1.2 OVERVIEW OF SAMPLING AND ANALYSIS PLANS

Site sampling is scheduled to take place in June through September, 1989. The sampling events will overlap, but will take place in approximately the following order:

1. Evaluation of three existing monitoring wells.
2. Surveyor establishes soil sampling grid.
3. Soil Sampling Phase I.
4. Review of sediment/bioassessment site locations.
5. Phase I Surface water, sediment, and biologic sample collection.
6. Review of Phase I soil sampling data.

AR300899

BROWN'S BATTERY BREAKING SITE

Section: 1.0  
Revision No.: 0  
Date: 15 May 1989  
Page: 2 of 20

7. Site selection for additional ground water monitoring wells and Phase II soil sampling locations.
8. Drilling and development of new monitoring wells.
9. Residential well sample collection, Phase I.
10. Soil sampling, Phase II.
11. Ground water well sample collection, Phase II.
12. Phase II Surface Water, sediment and biologic sample collection if warranted.
13. Survey of all soil sample site locations and ground water well locations/elevations.

The sampling events will be conducted in a manner which minimizes the number of mobilizations required for sampling this site.

**1.3 TYPES, LOCATION, AND NUMBER OF SAMPLES AND FIELD MEASUREMENTS**

Tables 1-1 through 1-4 summarize the types, locations, and numbers of samples and field measurements which will be made at each area of the site. The tables summarize the surface water samples, sediment samples, soil and ground water samples which will be collected during this RI. These tables do not include the quality control samples which will be collected as part of the sampling event. Quality Control (QC) samples are addressed in Section 11.0 of the QAPjP. Sample volumes, containers, preservatives and holding times are summarized in Table 1-5.

Twelve surface water and sixteen sediment stations will be sampled (Figure 1-1) during this RI. Both filtered and unfiltered surface water samples will be collected from each surface water station. One sediment grab samples will be collected at each sediment station.

During Phase I of the soil sampling plan, 60 soil samples will be collected outside the Containment Area (Figure 1-2). Data collected during the Phase I soil sampling effort will be used to define the scope of the Phase II effort. However, for planning purposes, fifty-two additional soil samples are tentatively planned for collection during Phase II. Phase II will also include sampling of the Containment Area soils and collection soil for treatability studies.

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TABLE 1-1  
SUMMARY OF ANALYSES FOR SURFACE WATER SAMPLES

Sample Code	Location	# of samples	Analysis
1 - SR1 1 - SR2	100' upriver of Fisher Ln Rd	1 unfiltered 1 filtered	TAL, TSS, pH, Temp, DO, A, H, C, Eh TAL, TCL
2 - SR1 2 - SR2	Near bank in deposition, 400' downriver of Fisher Ln Rd	1 unfiltered 1 filtered	TAL, TSS, pH, Temp, DO, A, H, C, Eh TAL
3 - SR1 3 - SR2	Near bank in deposition, 800' downriver of Fisher Ln Rd	1 unfiltered 1 filtered	TAL, TSS, pH, Temp, DO, A, H, C, Eh TAL
4 - SR1 4 - SR2	Near bank in deposition, 1300' downriver of Fisher Ln Rd	1 unfiltered 1 filtered	TAL, TSS, pH, Temp, DO, A, H, C, Eh TAL
5 - SR1 5 - SR2	Near bank in deposition, west of two islands	1 unfiltered 1 filtered	TAL, TSS, pH, Temp, DO, A, H, C, Eh TAL
6 - SR1 6 - SR2	In deposition, between two islands or downriver	1 unfiltered 1 filtered	TAL, TSS, pH, Temp, DO, A, H, C, Eh TAL
7 - SR1 7 - SR2	Near bank in deposition, 300- 500' downriver of large island	1 unfiltered 1 filtered	TAL, TSS, pH, Temp, DO, A, H, C, Eh TAL, TCL

Key:

SR = Schuylkill River  
MC = Mill Creek  
TAL = Target Analyte List  
Eh = Oxidation-Reduction Potential

DO = Dissolved Oxygen

Temp = Temperature

TCL = Target Compound List

A = Alkalinity

TSS = Total Suspended Solids

H = Hardness

C = Conductance

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TABLE 1-1  
SUMMARY OF ANALYSES FOR SURFACE WATER SAMPLES  
(continued)

Sample Code	Location	# of samples	Analysis
8 - MC1	In Mill Creek at the confluence with Schuylkill River	1 unfiltered	TAL, TCL, TSS, pH, Temp, DO, C, A, H, Eh
8 - MC2		1 filtered	TAL
9 - MC1	160' upcreek from confluence	1 unfiltered	TAL, TSS, pH, Temp, DO, C, A, H, Eh
9 - MC2		1 filtered	TAL
10 - MC1	Below railroad bridge	1 unfiltered	TAL, TSS, pH, Temp, DO, C, A, H, Eh
10 - MC2		1 filtered	TAL
11 - MC1	250' upcreek from rail road bridge	1 unfiltered	TAL, TSS, pH, Temp, DO, C, A, H, Eh
11 - MC2		1 filtered	TAL
12 - MC1	450' upcreek from rail road bridge	1 unfiltered	TAL, TCL, TSS, pH, Temp, DO, C, A, H, Eh
12 - MC2		1 filtered	TAL, TCL

Key: SR = Schuylkill River DO = Dissolved Oxygen A = Alkalinity  
MC = Mill Creek Temp = Temperature TSS = Total Suspended Solids  
TAL = Target Analyte List TCL = Target Compound List H = Hardness  
Eh = Oxidation-Reduction Potential C = Conductance

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1-1



TABLE 1-2

## SUMMARY OF ANALYSES FOR SEDIMENT SAMPLES

Sample Code	Location	# of samples	Analysis
1-SR/Sed	100' upriver of Fisher Ln Rd	1	TAL, TCL, pH, TOC, TA, B, Temp, C
2-SR/Sed	Near bank in deposition, 400' downriver of Fisher Ln Rd	1	Pb, pH, TOC, TA, Temp, C
3-SR/Sed	Near bank in deposition, 800' downriver of Fisher Ln Rd	1	Pb, pH, TOC, TA, Temp, C
4-SR/Sed	Near bank in deposition, 1400' downriver of Fisher Ln Rd	1	Pb, pH, TOC, TA, Temp, C, B
5-SR/Sed	In the SR, below confluence with Mill Creek	1	Pb, pH, TOC, TA, Temp, C
6-SR/Sed	Near bank in deposition, west of two islands	1	TAL, TCL, pH, TOC, TA, Temp, C
7-SR/Sed	Near bank in deposition, between two islands or downriver	1	Pb, pH, TOC, TA, Temp, C
8-SR/Sed	Near bank in deposition, 100' down from large island	1	Pb, pH, TOC, TA, B, Temp, C
9-SR/Sed	Near bank in deposition, 300'	1	Pb, pH, TOC, TA, Temp, C

Key: SR = Schuylkill River, MC = Mill Creek, Pb = Lead, TAL = Target Analyte List,  
 TOC = Target Compound List, TOC = Total Organic Carbon, TA = Texture Analysis,  
 B = Bioassessment Collection Site, Temp = Temperature

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TABLE 1-2

SUMMARY OF ANALYSES FOR SEDIMENT SAMPLES  
(continued)

Sample Code	Location	# of samples	Analysis
10-MC/Sed	In Mill Creek, at confluence with SR	1	TAL, TCL, pH, TOC, TA, B, Temp, C
11-MC/Sed	80' upcreek from confluence	1	Pb, pH, TOC, TA, Temp, C
12-MC/Sed	160' upcreek from confluence	1	Pb, pH, TOC, TA, Temp, C
13-MC/Sed	240' upcreek from confluence	1	Pb, pH, TOC, TA, Temp, C
14-MC/Sed	Below rail road bridge	1	Pb, pH, TOC, TA, Temp, C
15-MC/Sed	250' upcreek from rail road bridge	1	Pb, pH, TOC, TA, Temp, C
16-MC/Sed bridge	450' upcreek from rail road	1	TAL, TCL, pH, TOC, TA, B, Temp, C

Key: SR = Schuylkill River, MC = Mill Creek, Pb = Lead, TAL = Target Analyte List,  
 TCL = Target Compound List, TOC = Total Organic Carbon, TA = Texture Analysis,  
 B = Bioassessment Collection Site, Temp = Temperature

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TABLE 1-3  
SUMMARY OF ANALYSES FOR SOIL SAMPLES

Sample Code	# of samples	Analysis	Sample Code	# of samples	Analysis
1B - 1	1 deep+	Pb, TAL, TCL	16B - 1	1 deep	Pb, TAL, TCL
1B - 2	1 shallow	Pb	16B - 2	1 shallow	Pb
2B - 1	1 deep	Pb	17B - 1	1 deep	Pb
2B - 2	1 shallow	Pb, TAL, TCL	17B - 2	1 shallow	Pb
3B - 1	1 deep	Pb	18B - 1	1 deep	Pb
3B - 2	1 shallow	Pb	18B - 2	1 shallow	Pb, TAL, TCL
4B - 1	1 deep	Pb	19B - 1	1 deep	Pb
4B - 2	1 shallow	Pb	19B - 2	1 shallow	Pb
5B - 1	1 deep	Pb, TAL, TCL	20B - 1	1 deep	Pb
5B - 2	1 shallow	Pb	20B - 2	1 shallow	Pb
6B - 1	1 deep	Pb	21B - 1	1 deep	Pb
6B - 2	1 shallow	Pb	21B - 2	1 shallow	Pb, TAL, TCL
7B - 1	1 deep	Pb	22B - 1	1 deep	Pb
7B - 2	1 shallow	Pb	22B - 2	1 shallow	Pb
8B - 1	1 deep	Pb	23B - 1	1 deep	Pb
8B - 2	1 shallow	Pb	23B - 2	1 shallow	Pb
9B - 1	1 deep	Pb, TAL, TCL	24B - 1	1 deep	Pb
9B - 2	1 shallow	Pb	24B - 2	1 shallow	Pb
10B - 1	1 deep	Pb	25B - 1	1 deep	Pb
10B - 2	1 shallow	Pb	25B - 2	1 shallow	Pb, TAL, TCL
11B - 1	1 deep	Pb	26B - 1	1 deep	Pb
11B - 2	1 shallow	Pb	26B - 2	1 shallow	Pb

Note: All 60 samples will be analyzed for Pb using X-Ray Fluorescence. In addition, 20% of the samples will be analyzed for TAL metals, which includes Pb, by ICP analysis.

Key: B = Boring + sample depths are defined in text TCL = Target Compound List  
P = Lead TAL = Target Analyte List

TABLE 1-3  
SUMMARY OF ANALYSES FOR SOIL SAMPLES  
(continued)

Sample Code	# of samples	Analysis	Sample Code	# of samples	Analysis
12B- 1	1 deep	Pb	27B - 1	1 deep	Pb, TAL, TCL
12B- 2	1 shallow	Pb, TAL, TCL	27B - 2	1 shallow	Pb
13B- 1	1 deep	Pb	28B - 1	1 deep	Pb
13B- 2	1 shallow	Pb	28B - 2	1 shallow	Pb
14B- 1	1 deep	Pb	29B - 1	1 deep	Pb
14B- 2	1 shallow	Pb, TAL, TCL	29B - 2	1 shallow	Pb
15B- 1	1 deep	Pb	30B - 1	1 deep	Pb
15B- 2	1 shallow	Pb	30B - 2	1 shallow	Pb, TAL, TCL

Note: All 60 samples will be analyzed for Pb using X-Ray Fluorescence. In addition, 20% of the samples will be analyzed for TAL metals, which includes Pb, by ICP analysis.

Key: B = Boring + sample depths are defined in text TCL = Target Compound List  
Pb = Lead TAL = Target Analyte List

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Table 1-4

## SUMMARY OF ANALYSES FOR GROUND WATER SAMPLES

Sample Code	Location	# of Samples	Analyses
GW1 - 1	Field north of site (shallow well)	1 unfiltered	TAL, TCL, pH, Conductance, Temp
GW1 - 2		1 filtered	Pb, pH, Conductance, Temp
GW2 - 1	North of containment (shallow well)	1 unfiltered	Pb, pH, Conductance, Temp
GW2 - 2		1 filtered	Pb, pH, Conductance, Temp
GW3 - 1	Northeast of battery breaking building (deep well)	1 unfiltered	Pb, pH, Conductance, Temp
GW3 - 2		1 filtered	Pb, pH, Conductance, Temp
GW4 - 1	North of battery breaking building (shallow well)	1 unfiltered	TAL, TCL, pH, Conductance, Temp
GW4 - 2		1 filtered	Pb, pH, Conductance, Temp
GW5* - 1	South of containment area (shallow well)	1 unfiltered	Pb, pH, Conductance, Temp
GW5 - 2		1 filtered	Pb, pH, Conductance, Temp
GW6 - 1	Strausser well	1 unfiltered	TAL, TCL, Pb, pH, Conductance, Temp
GW7 - 1	Desing well	1 unfiltered	TAL, TCL, Pb, pH, Conductance, Temp
GW8 - 1	Nol well	1 unfiltered	TAL, TCL, Pb, pH, Conductance, Temp

Note: \* Optional well to be installed if existing wells are inadequate

Key:

GW = ground water

Pb = lead

TCL = Target Compound List

TAL = Target Analyte List

Temp = Temperature

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Table 1-5  
Sample Volume, Preservation, Holding Time and Container Requirements

Sample Type	Matrix	Method	Sample Vol./Mass	Container	Preserv.	Holding Time
<u>Physical Parameters</u>						
Conductance/TSS	W	Meter	N/A	N/A	N/A	No Holding (field test)
pH	S	SW 9045	N/A	N/A	N/A	No Holding (field test)
	W	pH meter	N/A	N/A	N/A	No Holding (field test)
Eh	W	Eh meter	N/A	N/A	N/A	No Holding (field test)
Total Organic Carbon	S	SW 9060 (CLP-M 415.13)	1 liter	G preferred	HCl to pH <2	28 days
<u>Metals</u>						
Lead	S	XRF	6 oz.	P, G	N/A	6 months
Lead (Total Recoverable) (Dissolved)	W	SW 3005/ SW 7421 (239.2 CLP-M)	1 liter 1 liter	P, G P, G	HNO <sub>3</sub> to pH <2 Filter on-site; HNO <sub>3</sub> to pH <2; Cool to 4°C	6 months 6 months

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Table 1-5 (continued)  
Sample Volume, Preservation, Holding Time and Container Requirements

Sample Type	Matrix	Method	Sample Vol./Mass	Container	Preserv.	Holding Time
Lead	B	SW 7421 (239.2 CLP-M)	10-15 organisms per site	foil	Cool to 4°C	24 hours
Antimony (Total Recoverable) (Dissolved)	W	SW 3005/ SW 7041 (204.2 CLP-M)	1 liter 1 liter	P,G P,G	HNO <sub>3</sub> to pH <2 Filter on-site; HNO <sub>3</sub> to pH <2	6 months 6 months
		SW 3050/ SW 6010 (200.7 CLP-M)	6 oz.	P,G	N/A	6 months
TAL (ICP Screen)	S	SW 3005/ SW 6010 (200.7 CLP-M)	1 liter	P,G	Cool, 4°C	24 hours
<u>Inorganic, Non-Metallic</u>						
Dissolved Oxygen	W	D.O. meter	N/A	N/A	N/A	No Holding (field test)
Hardness	W	E 130.1	1 liter	P	HNO <sub>3</sub> to pH <2	6 months
Alkalinity	W	E 310.1	1 liter	P	Cool to 4°C	14 days

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Table 1-5 (continued)  
Sample Volume, Preservation, Holding Time and Container Requirements

Sample Type	Matrix	Method	Sample Vol./Mass	Container	Preserv.	Holding Time
<u>TCL (Organic) Parameters</u>						
Volatile Organics	S	CLP after EPA Method 624	6 oz	G only	Teflon-faced glass VOA vials Cool to 4°C	14 days
	W	CLP after EPA Method 624	2-40 ml	G only	Teflon-faced, glass VOA vials. Cool to 4°C, Eliminate free air space. Add 4 drops concen- trated HCl per 40 ml vial.	14 days
BN/A Semi-Volatile Organics	S	CLP after EPA Method 625	6 oz	G only	Teflon-faced, Cool to 4°C, Eliminate free air space.	14 days
	W	CLP after EPA Method 625	1 gallon	(amber) G only	Teflon-faced vial. Cool to 4°C	7 days

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Table 1-5 (continued)  
Sample Volume, Preservation, Holding Time and Container Requirements

Sample Type	Matrix	Method	Sample Vol./Mass	Container	Preserv.	Holding Time
Organochlorine Pesticides and PCBs	S	CLP after EPA Method 608	6 oz	G only	Teflon-faced glass vials, cool to 4°C	14 days
	W	CLP after EPA Method 608	1 gallon	(amber) G only	Teflon-faced glass vials, cool to 4°C	7 days

Key:

1. W = Water, S = Sediment or Soil, B = Biologic Samples
2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.
3. The listed holding times are recommended for properly preserved samples based on currently available data. It is recognized that extension of these times may be possible for some sample types while, for other types, the times may be too long. When shipping regulations prevent the use of the proper preservation technique or when the holding time is exceeded, the final reported data for these samples should indicate the specific variance. If samples cannot be analyzed within the specified time intervals, the final reported data should indicate the actual holding time.

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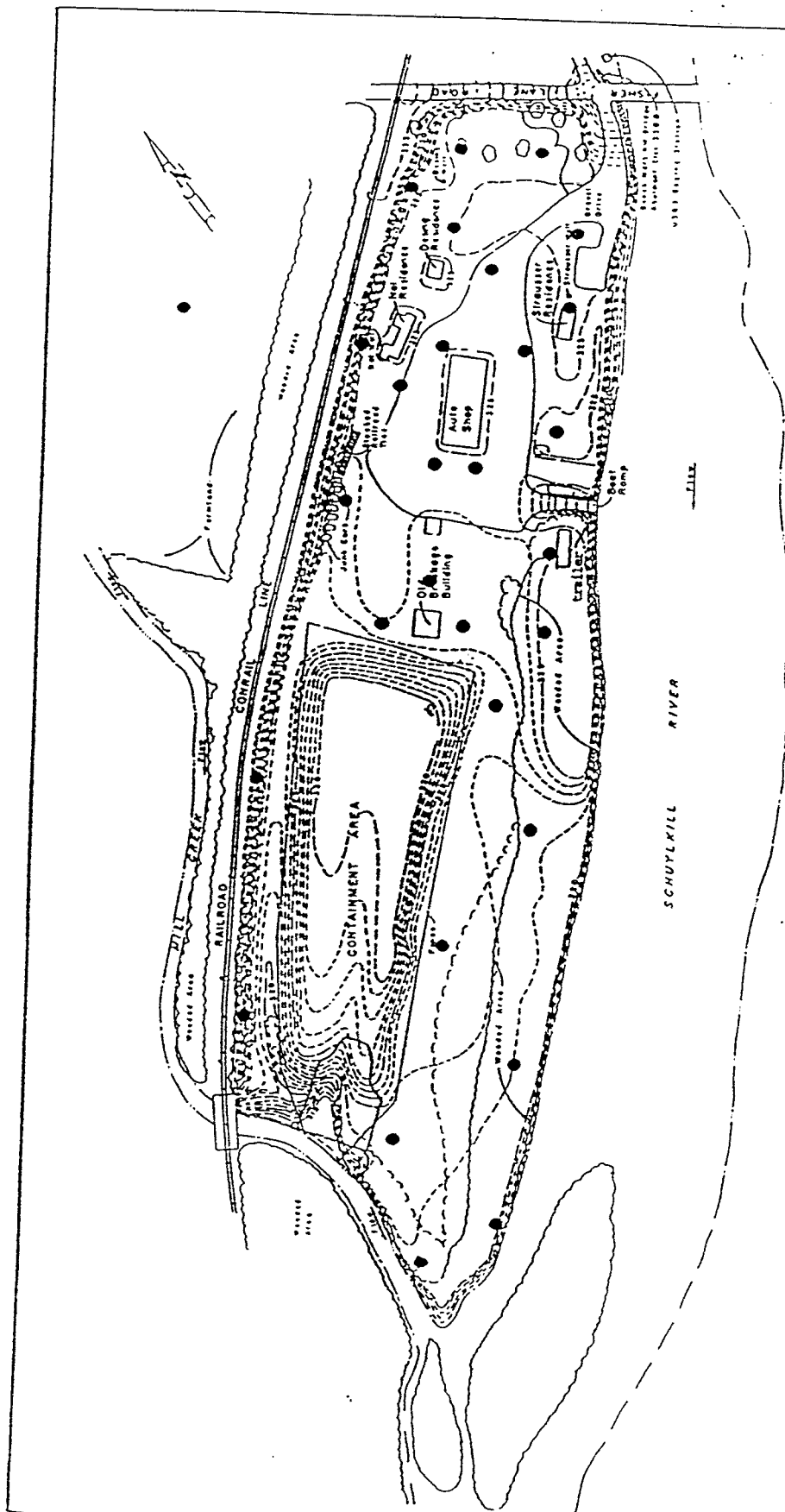
Table 1-5 (continued)  
Sample Volume, Preservation, Holding Time and Container Requirements

References include:

- SM = Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985).
- SW = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (USEPA 1986).
- ASTM = American Society for Testing and Materials, (1988).
- Required Containers, Preservation Techniques, and Holding Times, 40 CFR 136.3, Table II.
- CLP = Contract Laboratory Program, S.O.W. TCL 7/87  
S.O.W. TAL 12/87
- U.S. Fish and Wildlife -- "Multi-Element Analysis of Fish Tissue and Standard Referenced Matter Using ICP argon coupled plasma spectroscopy." See Appendix B.

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APPROXIMATE SOIL SAMPLING SITE LOCATIONS

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Scale: None

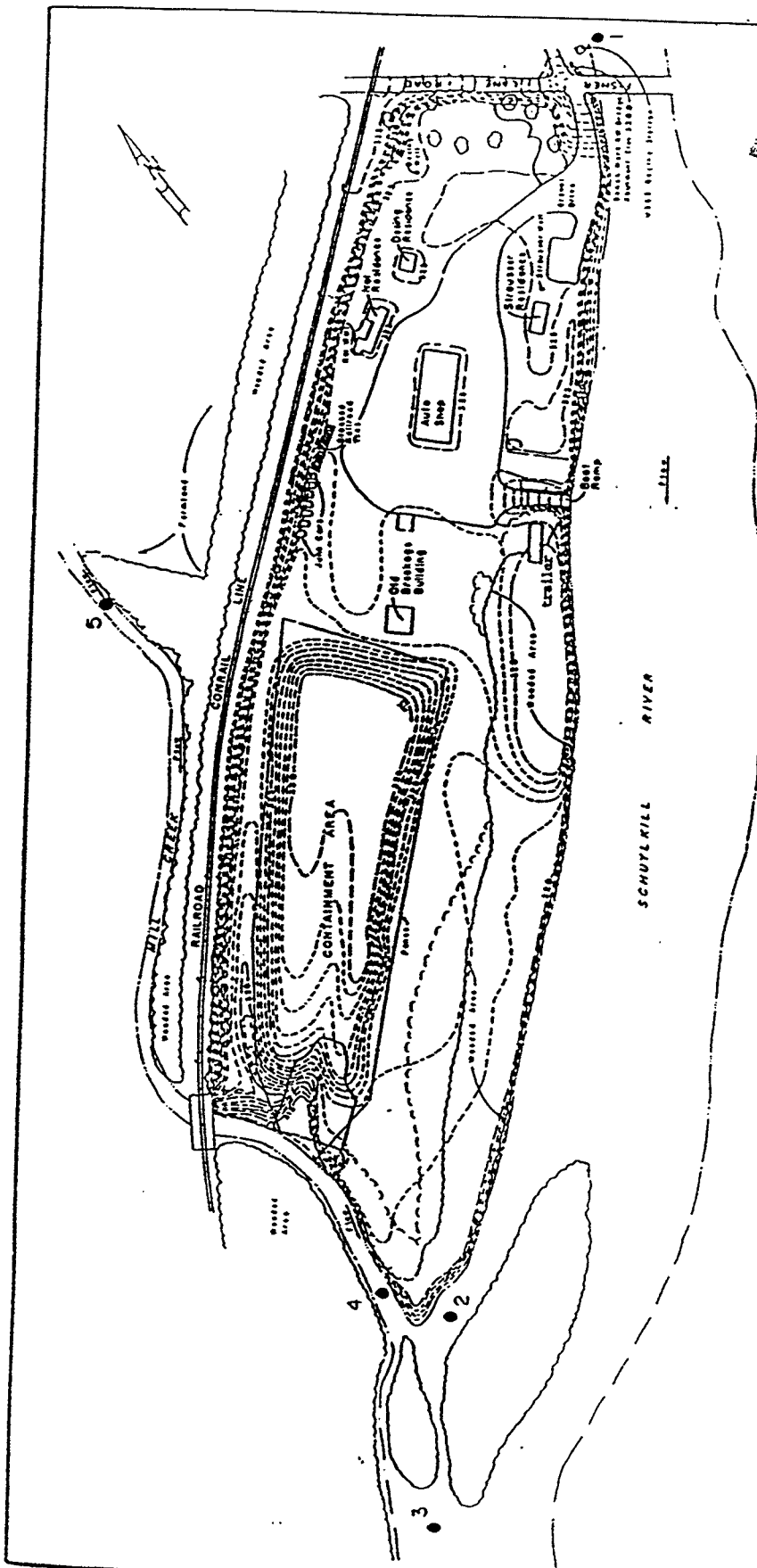
Source: Modified from land survey performed for Environmental Response Team, June 1984

WA No. 91-01-3684

Figure 1-2

Approximate Phase I  
Soil Sample Locations





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• CORBICULA SP. SAMPLING SITE LOCATION

AR30006

Scale: 1 inch = 100 feet  
Source: Modified from land survey performed  
for Environmental Response Team,  
June 1984

WA No. 91-01-3684

Figure 1-4

Approximate Corbicula sp.  
Sample Locations

Original  
(Red)

Six wells currently exist on the site. Three are monitoring wells and three are residential drinking water wells. Four additional monitoring wells will be drilled on the site as part of the ground water sampling plan (Figure 1-3). A fifth well may be installed should the condition of the existing monitoring wells prove to be inadequate for RI/FS purposes. During Phase I, only the three existing residential wells will be sampled.

The bioassessment study during Phase I includes aquatic species collection (Figure 1-4). Three sampling sites are located on the Schuylkill River and two are located on Mill Creek. If site conditions permit, aquatic assessment sample locations will be the same as five of the previously identified surface water/sediment locations. Terrestrial plants will be collected using clip plots located by random sampling during Phase II, if warranted.

All soil sampling sites and ground water well locations will be survey-located by a certified land surveyor following the final sampling event.

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## 2.0 SOIL SAMPLING PLAN

The following outlines the plan for soil sampling at the Brown's Battery Breaking Site.

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### 2.1 OBJECTIVES AND RATIONALE

The initial objective for soil sampling at the Brown's site is to establish whether soils outside of the Containment Area are currently contaminated with lead, antimony, or other Contract Laboratory Program (CLP) Target Analyte List (TAL) metals/Target Compound List (TCL) compounds, in concentrations which could lead to decreased environmental quality or pose a threat to human health. TAL (inorganic) and TCL (organic) analyses are being performed to determine if any unsuspected contaminants are present on site. The second objective is to measure potential contamination in and beneath the Containment Area and assess environmental and health threats posed by materials migrating from this area. The third objective for the soil sampling is to evaluate soil characteristics and collect samples for treatability studies which will be used in evaluating the remedial alternatives outlined in the Work Plan.

Soil sampling will take place in two phases. An initial soil screening of soils outside of the Containment Area will be conducted in the first phase of the soil sampling scheme. The analytical methods, sampling depths, QC parameters, and sampling locations assigned to the Phase I sampling are detailed below.

The second soil sampling phase will occur following receipt reduction and validation of the initial screening results. These results will be utilized, if applicable, to modify the placement of the second phase of soil samples. The soils beneath the Containment Area will also be sampled during this second sampling event. Representative samples of contaminated soils underneath the cap and in other areas on the site as appropriate, will be collected for remedial method evaluation. Treatability studies will be conducted on these samples to evaluate the effectiveness of stabilization/solidification and soil washing as remedial alternatives for this site.

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This stepwise soil evaluation is designed to concentrate soil analyses in areas of identified contamination. During phase two of soil sampling, three tasks will be undertaken:

- o The extent of contaminated areas identified in the initial phase will be delineated.
- o Soil materials in and underneath the containment area will be sampled.
- o Soil samples will be collected for treatability studies.

## 2.2 PHASE I - SOIL SAMPLING METHOD AND SAMPLING TECHNIQUES

### 2.2.1 Sample Locations

A one-hundred-foot square grid system will be survey located from points along the railroad line, located on the northwest property line of the site. This grid will be set prior to mobilizing a soil sampling crew. The 30 sampling points used for this screening will be located in the field from the grid. The 30 locations have been chosen based on historical data showing areas of known previous contamination. The sampling crew will locate the sampling points using 100-foot steel tape measures and a Brunton compass. Figure 1-2 illustrates the soil screening sample locations. Soil samples will not be collected in areas of ponded surface water.

### 2.2.2 Equipment

The following equipment will be used to collect Phase I soil samples:

- o Hand augers (bucket, screw) with extensions
- o Plastic spoons
- o Sample containers, labels, and shipping materials
- o Decontamination supplies
- o Plastic sheeting
- o Sample flags/stakes
- o Measuring tape

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### 2.2.3 Sampling Procedure

#### Surface Soil

1. Place plastic sheeting in a cleared area next to the sampling location; place all necessary sampling equipment on the sheet.
2. Clear any surface debris (leaves, twigs, etc.) with gloved hands.
3. Using a bucket auger, collect the top 0-6" of soils. Place the sample (6 oz.) into labeled sample jar using a disposable plastic spoon (for TCL samples, use only stainless steel tools).
4. Note the date, time, sampling grid location, and analyses on the label with indelible markers.
5. Process the sample for shipment as described in the QAPjP Section 7.0.
6. Mark the sampling location with a sample flag or stake.
7. Decontaminate equipment between samples.

#### Deep Soil

1. Place plastic sheeting in a cleared area next to the sample location; place all necessary sampling equipment on the sheet.
2. Clear any surface debris (leaves, twigs, etc.) with gloved hands.
3. Using a screw auger, advance the auger until the fill/natural soils interface is reached, or to 36 inches depth, whichever is reached first. An abnormal discontinuity in the soil texture or color, different from an undisturbed, stratified soil profile, indicates the interface of interest.
4. Carefully remove the screw auger and clean away all spoils from the hole.
5. Use the bucket auger to collect the soil sample. Use a disposable plastic spoon (stainless steel for TCL samples) to place the sample in the sample jar.

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6. Measure the depth of the sample with the measuring tape.
7. Note the date, time sample grid location, and analyses on the label.
8. Process the sample for shipment as described in the QAPjP Section 7.0.
9. Mark the sampling location with a sample flag or stake.
10. Decontaminate the equipment between samples.

#### 2.2.4 Sample Analyses

A Kevex, laboratory X-Ray Fluorescence Spectrophotometer located at the Central Regional Laboratory (CRL), will be used to analyze the lead concentration of the soil samples obtained during this first phase. The detection limit set by the CRL for this analytical method is 100 ppm. Soil samples will be packaged and shipped according to the Contract Laboratory Program (CLP) protocols outlined in the QAPjP.

Twenty percent of the soil samples (splits) will also be sent to a CLP laboratory for TAL and TCL analyses in accordance with standard CLP collection and analytical procedures.

### 2.3 PHASE II - SOIL SAMPLING

The final depths, locations, and sampling methods of the Phase II soil samples will be determined by the results of the Phase I soil sampling and historic soil contamination data for the site. The PM and Remedial Project Manager (RPM) will identify the sampling locations and depths which will be used in Phase II, following Phase I data validation, reduction, and evaluation. Areas identified during Phase I with lead concentrations exceeding 500 ppm (five times the detection limit), will be resampled during Phase II. During this second sampling event, the extent of contamination around these points will be further defined.

Residual soil from two locations beneath the Containment Area will be obtained using backhoe pits. Residual soil from a depth of six inches below the bottom of the disturbed soil will be collected and analyzed for EP Toxicity, pH, Eh, and TAL/TCL.

AR300921

BROWN'S BATTERY BREAKING SITE

Section: 2.0  
Revision: 0  
Date: 15 May 1989  
Page: 5 of 5

Samples will also be collected during Phase II for subsequent treatability tests. Remediation techniques being evaluated through treatability tests include stabilization/solidification and soil washing. Samples used for treatability testing will be collected in a fifty-five gallon drum until distributed conducting treatability studies. Optional soil property testing may include bulk density, cation exchange capacity, particle size analysis, permeability, etc. The specific protocols for obtaining treatability samples will be developed at a later date.

AR300922

### 3.0 SURFACE WATER AND SEDIMENT SAMPLING PLAN

The following sections detail the sample collection methods, locations, sample handling and analyses planned for the surface water and sediment sampling of Mill Creek and the Schuylkill River, near the Brown's Battery Breaking Site.

#### 3.1 OBJECTIVES AND RATIONALE

The purpose of sampling surface water and sediments surrounding the site is to establish the current impact of site conditions on local environmental conditions. Background samples on Mill Creek and the Schuylkill River upstream of the site will be used to compare site-generated contributions of lead to these surface waters against potential upstream sources.

The section of the Schuylkill River adjoining the study site is scheduled for river reclamation and the reestablishment of shad.

#### 3.2 SURFACE WATER AND SEDIMENT SAMPLING

##### 3.2.1 Sample Locations

Twelve sampling points are planned for collection of surface water and sixteen sampling points are planned for collection of sediments during the sampling event. Seven sediment and five surface water sites are located in Mill Creek. Nine sediment and seven surface water sampling locations are sited in the Schuylkill River. Figure 1-1 indicates the approximate locations of the sampling sites. Each sample location will be modified to accommodate both sediment and surface water sampling requirements. The final location of each sediment sampling point will be in an area of sediment deposition. Samples will not be collected from the bank. In addition, five of the surface water/sediment locations will be evaluated for collection of bioassessment samples. Section 5.0 of the SAP details the sample requirements for the Bioassessment Study.

Samples will be collected in a down river to upriver direction to prevent contamination from sampling-generated, resuspended sediments. Depending upon the depth of each body of water during sample collection, sampling points will be accessed by wading into the water wearing the appropriate protective clothing. If high water levels or rapid water flow make wading impossible, the PM will elect to either postpone sampling or obtain a boat for continued sampling.

AR300923

The water samples will be collected before the sediment samples. Water samples will be collected from the bulk flow of the water column and not from the surface. Sediment samples will be collected using a Ponar or Eckman grab sampler. A detailed description of the sample locations and conditions at the time of sample collection will be recorded in the log book. The volume, holding time and preservation for each analytical method employed during sampling of this site is summarized in Table 1-5 of the SAP.

### 3.2.2 Equipment

The following equipment will be used to collect surface water and sediment samples:

- o Hip waders
- o Boat with trolling motor (optional)
- o Ponar or Eckman grab sampler
- o pH meter with Eh probe
- o Conductivity/TSS meter
- o Dissolved Oxygen (DO) meter
- o Thermometer
- o Water filter with pump
- o 0.45 micron filters
- o Sample containers, labels, and shipping materials
- o Dedicated glass containers for collecting samples for filtering

### 3.2.3 Sampling Procedure

#### Surface Water

1. Measure the pH, Eh, temperature, and DO at the sample location and depth.
2. Standing downstream of the sampling location, submerge the sample container into the water column (approximately 1 foot below surface), position the container mouth so that it faces upstream.
3. Preserve the sample with nitric acid to pH 2 as per QAPjP.
4. For filtered samples, run the sample through a 0.45 micron filter prior to acidifying.
5. Note the date, time location, and analysis on the container label and sample tag.

AR300924

6. Process the sample for shipment as described in the QAPjP Section 7.0.

#### Sediment

1. Collect at least three small, equal-sized samples from several points along the sediment deposition area.
2. Deposit the sample portions in a clean, 1/2 gallon wide-mouth jar. Carefully stir portions together into one composite.
3. Transfer the composited sludges into the sample containers.
4. Note the date, time, location and analysis on the container label and sample tag.
5. Process the samples for shipment as described in the QAPjP Section 7.0.

#### 3.2.4 Sample Analysis

Both filtered and unfiltered surface water samples will be collected at each sampling point to establish total metal content as well as the contamination from dissolved forms of metals (SW 6010). All samples will be analyzed for TAL. In addition, all unfiltered samples will be tested for pH, Eh, temperature, dissolved oxygen (DO), conductance, total suspended solids (TSS) alkalinity and hardness. Twenty percent of all the samples taken will be analyzed for TCL (CLP after EPA Method 608, 624, and 625) compounds.

All sediment samples will be analyzed for TAL-lead (SW 6010), pH, total organic carbon, temperature, and conductivity. pH analysis will be performed in the field using a portable pH meter kit. Twenty percent of the samples collected will be analyzed for TAL/TCL compounds. A standard texture analysis will be performed in the field to determine that the sediments are predominantly clays and silts rather than sands or gravels. Sample results will be normalized based on the organic content and clay content. Table 1-2 summarizes the sample location, number of samples and analyses to be performed on each sediment sample.

AR300925

#### 4.0 GROUND WATER SAMPLING PLAN

The following section describes the ground water sampling plan for the Brown's Battery Breaking Site.

##### 4.1 OBJECTIVES AND RATIONALE

The ground water sampling plan for this site will consist of five tasks divided into two phases. Tasks one and two will be performed in Phase I. The first task is to evaluate the current usefulness of the three existing monitoring wells on the south and southeast ends of the Containment Area. These wells were bored on March 22, 1984 as part of the CERCLA Immediate Removal Action. Methods which will be used to assess the integrity of these wells are outlined in Section 4.2. The second task involves sampling the three onsite residential wells.

Tasks three, four, and five are included in the Phase II activities. The third task will consist of establishing the final locations of the additional four monitoring wells. Preliminary well locations, based on historic site data, are illustrated in Figure 1-3. Information derived from the three existing monitoring wells, if useful, and soil screening activities will be used to modify these preliminary locations if deemed appropriate by the PM and site hydrogeologist. The PM, in conjunction with the site hydrogeologist and RPM, will finalize the well locations prior to drilling.

Task four consists of drilling and developing the new wells. Should the evaluation of existing wells determine that the existing wells cannot be used, a fifth new well will be installed.

The fifth task is to obtain water samples from the wells on site and conduct appropriate hydrogeologic tests for each well. The ground water sampling will include the three existing potable water wells, three existing monitoring wells, if possible, and the new monitoring wells. Table 1-4 outlines the specific water quality parameters which will be tested at each well location. Each well will be sampled once. A filtered and unfiltered water sample will be collected from each well during each sampling event.

AR300926



The rationale for implementing the well program in this stepwise fashion is to utilize any and all applicable existing site information to optimize well placement. The objectives of the ground water sampling plan are to:

1. Determine lead concentrations in the ground water.
2. Establish the depth and number of aquifer(s) underlying the site which are important when considering migration potential.
3. Collect hydrogeologic data to define the hydraulic conductivity and transmissivity of the aquifer(s).

#### 4.2 EVALUATION OF EXISTING SITE MONITORING WELLS

The first task for each existing monitoring well will be to identify and record information regarding the physical appearance of the well. Observations will include but not be limited to:

- o Pad integrity/condition;
- o Condition of well caps, locks and risers; and
- o Any notable staining or cracks in the viewable portion of the interior or exterior well casing.

This visual evaluation will be followed by depth determination and bailing the monitoring wells. Depth determination will be accomplished using a metal tape which is calibrated in 0.01-foot increments. Total depth of the well will be compared to well construction data to determine if the well is obstructed. The total well depth and depth to the static water level will be measured to the nearest 0.01 foot. This measurement will be taken from an established point (i.e., notch) at the north edge of the casing. The elevation of the reference point will be established by a licensed Pennsylvania land surveyor. Static water level elevation data will be used in mapping the water table, if the condition of the well is judged acceptable. Further information on recording static well levels can be found in Section 7.0, Site Management. Bailing will be implemented to the extent deemed necessary by the site hydrogeologist. Bailing will continue until terminated by the site hydrogeologist. The use of additional well development techniques, such as an air lift, will be determined on a case by case basis. Each well will be evaluated qualitatively for the ability to recover and recharge following bailing.

AR300927

Slug tests will not be performed on the existing monitoring wells due to the fact that the total bore diameter and other pertinent well construction parameters are unknown.

The final decision regarding the current use of each monitoring well will be determined based upon the results of field tests. In the worst case situation, if an existing monitoring well(s) would be found to be unacceptable for use, a decision would need to be made jointly by the site hydrogeologist, PM and RPM regarding the potential need for installing any additional monitoring well(s) to replace the one(s) taken out of service.

#### 4.3 SAMPLING ON-SITE RESIDENTIAL WELLS

During the Phase I program the three on-site residential wells will be sampled. Only unfiltered samples will be collected.

##### 4.3.1 Equipment

The following equipment is required for residential tap water sampling:

- o pH meter
- o Conductivity/TSS meter
- o Thermometer
- o Sample containers, preservatives, and shipping materials

Sample volumes, containers, preservatives and holding times are discussed in the QAPjP Section 6.0 and summarized in Table 1-5 of the SAP.

##### 4.3.2 Procedure

To collect the samples the following procedure will be used:

1. Open the tap and allow the water to run for several minutes and until the pH, conductivity and temperature readings stabilize. Utilize the tap closest to the well head, preferably between well and pressure tank/water conditioner.
2. Fill the sample bottles.
3. Seal and label the sample bottles.

AR300928

#### 4.3.3 Sample Analysis

Unfiltered residential tap water will be analyzed for lead (SW 7421), pH, conductance, and temperature.

#### 4.4 SELECTION OF FINAL WELL LOCATIONS

Historically, the breaking of batteries on this site occurred around the battery breaking building. In addition, spent casings were stockpiled and buried in various locations around the site as noted in the Extent of Contamination Survey (EOC), conducted in 1983. The four (or five) additional monitoring wells planned for the Brown's Site have been initially located in response to these historic depositional patterns. Figure 1-4 illustrates the proposed placement of the new wells. Table 4-1 gives anticipated well depths and zones monitored. However, due to the removal action which was initiated in 1984 and the disturbances created as a result of this removal action, the decision regarding final well placement will also take into consideration the results of the soil screening and the preliminary evaluation of the existing three monitoring wells on this site. The site hydrogeologist, PM and RPM will potentially modify the new well locations based upon these additional data.

TABLE 4-1

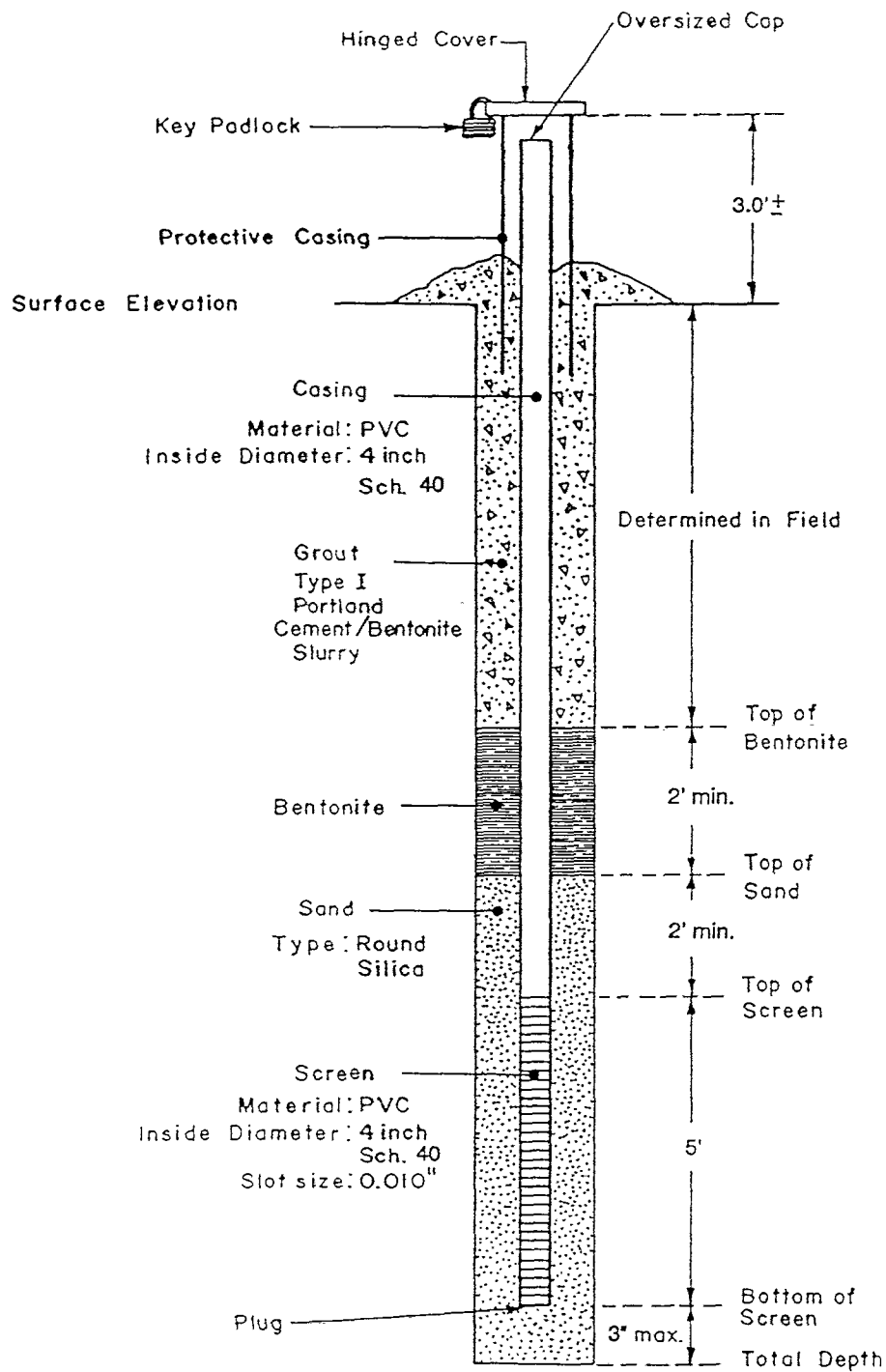
#### PROPOSED MONITORING WELL DEPTHS AND ZONES MONITORED

Well No.	Total Depth	Screened or Open Interval	Zoned Monitored <sup>1</sup>
1	15 feet	10-15 feet	Overburden
2	15 feet	10-15 feet	Overburden
3	40 feet	25-40 feet	Bedrock
4	15 feet	10-15 feet	Overburden
*5	15 feet	10-15 feet	Overburden

<sup>1</sup> Depths and Intervals given are estimates, and may vary according to conditions encountered in the field.

\* Optional shallow well

AR300929



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FIGURE 4-1  
TYPICAL MONITORING WELL  
CONSTRUCTION

AR300930

#### 4.5 WELL CONSTRUCTION, INSTALLATION AND SAMPLING

Monitoring wells will be drilled using either an 8 1/4 inch I.D. hollow-stem auger drilling method or air rotary method. Wells drilled in unconsolidated overburden materials will be drilled using hollow-stem augers. Wells drilled in bedrock will be drilled using the air rotary method. The compressed air supply will be filtered prior to introduction into the well, to remove oil or other contaminants. All wells will be four inch I.D., Schedule 40 PVC casing and well screening. The wells are designed to: (1) allow sufficient ground water flow for well sampling; (2) minimize the passage of formation materials (turbidity); and (3) ensure sufficient structural integrity to prevent the collapse of the intake structure. Borehole diameter will be recorded by the site hydrogeologist. Figure 4-1 illustrates typical well construction for a screened sand-packed well.

##### 4.5.1 Casing/Screens

Well construction will consist of a standard procedure for inserting slotted and solid casings into a borehole. For overburden wells, casing, filter pack, bentonite seal, and Portland cement/bentonite grout are placed in the annulus between the hollow-stem augers and casing/screen as the augers are withdrawn. For bedrock wells, casing will be lowered into the open borehole, or through a temporary casing if caving is a problem. The well casings will be constructed of four inch I.D., schedule 40 PVC casing. The screen size will be 0.01 inch (ten/slot) or as determined by the site hydrogeologist. Depending upon well depth and conditions, 5-10 feet of screening will be installed for overburden wells, and 20 to 30 feet of screening will be installed in bedrock wells. Casing sections will be flush threaded with screw joints. To prevent introduction of contaminants into the well, no glue-connected fittings will be used. Each piece of PVC pipe, screen, and the plug will be steam-cleaned before lowering into the borehole. The site hydrogeologist is responsible for the supervision of all steam cleaning procedures.

##### 4.5.2 Sand Packs

Once the casing is in place the sand pack will be added. Only washed and bagged, rounded silica sand with a grain size distribution compatible with the screen and formation will be utilized. For overburden wells, sand will be poured or emplaced down the annular space between the well casing and hollow-stem augers. For bedrock wells, sand will be poured or tremied down the annular space between the well casing and borehole. 483089304

temporary casing if used. The pack material will extend from the bottom of the screen to a minimum of two feet above the screen.

The volume of sand needed to fill the annular space will be calculated. Bridging of materials may be indicated if less than the calculated volume is needed to fill the space. If this situation occurs, a tremie pipe will be used to break the bridging and correctly fill the space.

The site hydrogeologist will record the start and stop times of the sand packing, the depth intervals that sand was packed, the amount of sand used, and any problems that arise. The hydrogeologist will also record the type of materials used for packing, including: trade name, source, supplier, and typical grain size distribution. A sample of packing sand will be collected and archived as part of the project files.

#### 4.5.3 Bentonite Seal

A bentonite seal of minimum two-foot vertical thickness will be placed in the annular space above the sand pack to separate the permeable zone(s) from the cement surface seal. For bedrock wells, the screened interval and top of sand pack will be placed a minimum of five feet below the bedrock surface, so that the bentonite seal and annular grout effectively isolate the well screen from the overburden. The bentonite is emplaced through a tremie pipe or poured directly into the annular space between well casing and hollow-stem augers (borehole wall for bedrock wells), depending upon the depth and site conditions. The bentonite used will either be pourable pellets or a slurry that is thick enough to prevent significant penetration of the underlying sand pack. Pourable pellets will not be used in cases where they must settle through more than 20 feet of water. The hydrogeologist will record the start and stop times of the bentonite seal emplacement, the interval of the seal, the amount of bentonite that was used, and any problems that arose. The type of bentonite and the supplier will also be recorded. A sample of the bentonite used on this site will be collected and archived as part of the project files.

#### 4.5.4 Cement Grout and Protective Casing

The Portland cement/bentonite grout mixture will be composed of a 6:1 Portland to bentonite ratio, measured on a dry weight basis. High grade bentonite will be used for this purpose. The final product will contain enough water to create a pumpable but not a "runny" mixture (approximately 6-7 gallons per 94 lb bag of cement). The mixture will be prepared in an above-ground mixer and mechanically blended on-site to produce a lump-free product.

AR500932

For overburden wells, the hollow-stem augers will be left in the hole during grouting to the extent that is practical. The grout will be pumped through a tremie pipe which will be placed just above the top of the bentonite seal after the seal has been allowed to hydrate. The grout will be pumped until undiluted grout is detected at the surface. The tremie pipe and the remainder of the auger will then be removed, and additional grout will be added to compensate for the volume of the removed pipe and auger (overburden wells only).

After the grout has partially set, a vented, five-foot length of steel protective casing will be set in the grout, extending approximately two feet below ground surface. After the grout has completely set, depressions due to settlement will be filled in by the same grout mixture previously used. The start and stop times of the cementing, the intervals that were cemented, the amount of cement used, the mix (gallons of water per bag of cement and bentonite) used, any additives to the cement, and any problems that arose during grouting will be recorded on the well construction log.

#### 4.5.5 Well Development

Well development is the process by which the aquifer's hydraulic conductivity is restored by removing drilling fluids, solids and other mobile particulates from newly installed wells. Two methods of well development that may be used at Brown's Battery Breaking Site are: (1) surging and bailing and (2) overpumping.

Surging and bailing will be performed manually. The steps for bailing by hand are:

1. Total depth of the well (TD) and depth to water (DTW) will be measured.
2. Calculate casing volume (CV) using the formula  
$$CV = (TD - DTW) * c$$

where c is the conversion factor for gallons based on well diameter; c = .65 for 4" well  
c = .16 for 2" well

3. Casing volumes will be used as a guide for total volume of water to be bailed.
4. Using a surge block, surge 5-foot sections of well screen, using 10-20 up/down cycles per section. Periodically remove the surge block and bail accumulated sediment from the well, as required.

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5. Alternatively, use a long bailer (preferably three feet long) surge by lifting and dropping the bailer through the column of water in the well. Surge the entire screen interval by five-foot sections using approximately 10-20 cycles per section.
6. After surging is complete, pH and specific conductance meters will be calibrated.
7. The pH, specific conductance, temperature, and water clarity will be monitored for every casing volume bailed (every five gallons bailed is often convenient when bailing into a bucket).
8. Water quality parameters (pH, conductance, temperature and turbidity) will be monitored until the well recharges ( $\pm 10\%$  of previous casing volumes) or until the test is terminated by the site hydrogeologist.
9. The well can be considered developed when the water is clear (i.e., silt and suspended particle content is low). The water quality parameters will be used as indicators of reaching equilibrium.

Overpumping may also be used in conjunction with surging/bailing for proper well development. Steps 1 to 3 are identical as outlined above. Step 4 is modified in that a submersible pump will be lowered into the well. Steps 5, 6, 7, and 8 are as outlined above. The pump must be rated to achieve the desired yield at a given depth. The pump system should include:

1. A check valve to prevent water from running back into the well when the pump is shut off.
2. Flexible discharge hose.
3. Safety cable or rope to remove the pump from the well.
4. Flow meter system (measuring bucket or inline flow meter).
5. Electric generator.
6. Ammeter, which measures current.

AR300934



The ammeter is used to monitor pump performance. If the pump is becoming clogged, the current will increase due to stress on the pump. If the water level drops below the intake ports, the current will drop due to decreased resistance on the pump.

All water, mud or slurry generated during the development of monitoring wells on this site will be containerized and stored, according to the directives of the RPM, until test results are received.

#### 4.5.6 Well Protection and Marking

A protective casing will be placed around the exposed well casing and seated in a 2 foot by 2 foot by 4 inch thick concrete surface pad. The concrete pad will be graded to slope away from the well. The protective casing will include a hinged cap. The cap will be padlocked for protection and will either have identical keys, or be keyed for opening with one master key.

For wells which are located in heavy traffic areas, the wells will be protected with three metal guard posts which will be installed around each well. The guard posts will be installed outside of the concrete pad and will be set in concrete and filled with concrete, as appropriate for the site.

The number of each well will be clearly marked on the well protective casing, both in paint and by impact numbering.

#### 4.5.7 Well Sampling

The well sampling is currently scheduled for Phase II. The Phase II program will be scoped based on Phase I results of all media, but will occur along the following guidelines.

The static water table elevation will be measured prior to each sampling event. These measurements are important to determine any changes in horizontal or vertical flow gradients. A sounding device or steel tape will be used to determine the depth of the water to within 0.01 feet. This equipment will be constructed of inert material and decontaminated prior to each use.

Prior to collection of representative groundwater samples, a well must be purged of; 1) stagnant water in the well, 2) water in the gravel pack; and 3) aquifer water that has been affected by the presence of the well. A minimum of three well volumes must be removed to insure a representative sample has been collected. The pH, conductivity, and temperature will be monitored during purging. A representative sample is collected when these parameters have stabilized to within 10 percent of the previous

AR300935

value. If the well is bailed dry during the evacuation of three borehole volumes, the well will be allowed to recover for up to 24 hours or until it recharges before sampling. Wells which do not recover within this time frame will not be sampled. A

As mentioned above pH, specific conductance, and temperature will be measured when each ground water sample is collected. A conventional pH meter with a gel-filled electrode will be used. A conductivity meter and a digital thermometer will be used for the remaining field measurements. All instruments will be calibrated daily to ensure accuracy. All probes will be thoroughly rinsed with distilled water prior to and following measurements.

Regardless of the sample collection method (grab, bailer, or pump), a representative water sample will be placed in a nalgene transfer bottle, used solely for field parameter determinations, unless it is possible to make measurements directly at the well discharge point. Measurements will be made as follows:

- o The transfer bottle will be rinsed with sample water prior to filling;
- o Probes will be immediately submerged in the transfer bottle and measurements will be taken accordingly;
- o All field measurements will be recorded in a field notebook along with the sample location, the time and the date of measurement, and the sampler's name; and
- o After parameters are obtained, the transfer bottle and the probes will be decontaminated by rinsing with distilled water. If the transfer bottle cannot be cleaned, a new bottle will be used.

A stainless steel or teflon bailer will be used to collect samples. The bailer will be lowered down the casing on a nylon line. Plastic sheeting will be placed around the well-head to ensure that the bailer line does not touch the ground while raising or lowering the bailer down the well. The sample will be poured from the bailer directly into the sample container for unfiltered samples. All unfiltered samples will be analyzed for TAL-lead. Twenty percent will be analyzed for TAL/TCL. A second sample will be filtered prior to analysis. Samples will be analyzed for TAL-lead. Filtered sample volumes, containers, preservatives and holding time for ground water samples are summarized in Table 1-5.

AR300936

#### 4.6 HYDROGEOLOGICAL TECHNIQUES

Hydrogeological measurements will be taken following satisfactory well development. These measurements include recording static water levels and conducting slug tests, which are discussed in the following paragraphs.

##### 4.6.1 Static Water Levels

Static water levels will be taken in all monitoring wells. A preliminary measurement will be made to the surface of the water using a battery powered sounder or steel tape. A final depth determination will be made using a steel tape which is calibrated in 0.01 foot intervals. The readings will be recorded to the nearest 0.01 foot, from an established reference point on the north side of the well casing. The elevation of this point will be survey established and referenced to the U.S.G.S. benchmark located on the northwest corner of the Fisher's Lane Bridge Abutment (330.0).

If a sounder is utilized during this field investigation, the sounder will be accompanied by a calibration logbook which will show the time and date of last calibration (before entering the field); the point of calibration (either the center of a mark or along the extreme of the first mark near the probe); the name of the technician performing the calibration; and how it was accomplished.

The information obtained from compiling static water levels of the wells on site will be used to map potentiometric surfaces and to aid in the determination of aquifer relationships.

##### 4.6.2 Slug Tests

Slug tests will be conducted on the monitoring wells that are installed during this RI. These tests will assist in determining hydraulic conductivity and transmissivity of the aquifer(s). The slug tests will be performed by adding an object of known volume displacement (slug) into the well and measuring the rate at which the water level declines in the well. After the water level stabilizes, the slug will be removed, and the recovery rate will be recorded. A pressure transducer will be calibrated and placed in the well. The pressure transducer will be utilized to measure the ground water level over time. This device was chosen for the ability to frequently monitor water level. Water level data will be recorded on a Hermit Datalogger.

AR300937

The methodology for data analysis which will be followed for this operation is taken from Bouwer, Herman and Rice, R.C., "A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells", Water Resources Research Bulletin, v. 12, no 3, pp. 423-428 (1976).

#### 4.7 DATA REPORTING

Well logs will be recorded and maintained for each well by the site hydrogeologist. Each log will contain information outlined in the QAPjP, Section 8.0. Figure 4-2 illustrates information recorded for a standard well log. Data reporting for wells on the Brown's Battery Breaking Site will follow the protocols set forth in Section 8.0 of the QAPjP.

AR300938



## 5.0 BIOASSESSMENT STUDY

The bioassessment study for Brown's Battery Breaking Site will include aquatic indicator species during Phase I. Terrestrial species may also be included during Phase II. The following sections describe the collection methods, species, and analytical parameters which will be used during this bioassessment study.

### 5.1 OBJECTIVES AND RATIONALE

Selected biological species can be used as indicators of environmental contamination. Certain species have the ability to bioaccumulate pollutants of concern and can therefore be used as a measure of overall contamination. Information collected through bioassessment studies will be used to assess pollutant migration potential and the extent of environmental hazard on and around this site.

### 5.2 RIVER AND STREAM SAMPLES

The indicator species selected for biomonitoring the Schuylkill River and Mill Creek is Corbicula sp., or other common freshwater clams inhabiting area waterways. Snails have been chosen as a secondary indicator species, where clams are not found or where they are not found in sufficient numbers to constitute a complete sample. Clams and snails were chosen for both their recognized ability to bioaccumulate lead and for their relative immobility.

#### 5.2.1 Sample Locations

Five sampling sites have been selected for the Phase I identification of aquatic bioconcentration of lead. Sites selected for collecting these species are indicated on Figure 1-4. These sites will be modified in the field by the following criteria:

- o Efforts will be made to utilize sampling sites in sedimentation zones and areas already identified for surface water/sediment sampling (see section 3.0). These sites include sites 1, 4, 8, 10 and 16.
- o Where clams or snails are not located in sedimentation zones, other zones will be reviewed.

AR300940

- o Sediment samples will be co-collected with biologic species for grain size analysis and analysis of lead concentration.
- o Endangered species will not be sampled. Table 5-1 contains a list of endangered species of snails and clams in the study area.

Table 5-1

Endangered or Threatened Species  
of Snails and Clams in Study Area

Scientific Name	Common Name	Range
<u>Plethobasus cooperianus</u>	Orange-footed, Pearly Mussel	Ohio, Cumberland, Tennessee and Mississippi River Systems north to Minnesota [U.S.A., AL, IN, IA, KY, OH, PA, TN]
<u>Lampsilis orbiculata</u>	Pink mucket, Pearly Mussel	Eastern half of U.S. [U.S.A., AL, IL, IN, KY, MO, OH, PA, TN]

Source: Range data, Pennak, 1978 and Fish and Wildlife  
Endangered and Threatened Species List, April 1987.

#### 5.2.2 Equipment

The following equipment is required to sample for freshwater clams:

- o Ponar or Eckman sampler
- o Small knife for shelling clams
- o Aluminum foil
- o Shipping containers and materials

AR300941

### 5.2.3 Procedure

1. Collect the clams or snails using a Ponar or Eckman dredge sampler in deeper water or by hand picking in shallower water.
2. Wash samples with river/stream water until free of sediment. Ten to fifteen individuals will be collected in each sample area, for an estimated 25 grams of wet weight. Clams will be collected as the specimen of first choice. Snails will be collected only if clams are not found in sufficient numbers at a collection point.
3. Following preliminary washing, shell the clams and transfer the viscera onto aluminum foil for wrapping.
4. Seal the foil in plastic bags and handle according to Section 7.0 of the QAPjP. The samples will be iced as soon as possible. Samples will be shipped to the CLP laboratory for special analytical services (SAS), biological tissue samples.

### 5.2.4 Sample Analysis

Analytical procedures used for the sample collection, handling and identification of lead concentrations in tissue samples are taken from the U.S. Fish and Wildlife Method entitled, "Multi-element analysis of fish tissue and standard referenced matter using ICP argon coupled plasma spectroscopy", K.A. Hausknecht, et al., Jarrell Ash Plasma News Letter, Volume 6, No. 1, April 1983 and "Contamination from Battery Salvage Operations on the Chipola River, Florida", Parley V. Winger, Donald Schultz, and W. Waynon Johnson, in the proceedings of the annual conference of S.E. Association of Fish and Wildlife Agencies, Volume 39, pages 139-145.

AR300942



## 6.0 REPORTING AND SCHEDULING

## 6.1 FIELD DATA REPORTS

Daily logs will be maintained onsite by the PM and field sampling staff members. The PM is responsible for transferring the logbooks to the appropriate sampling staff members and then for collecting and storing the logbooks until the beginning of the next sampling day or event. Field staff sign their logbooks upon receipt and use them to record all pertinent information until the sampling for that particular day is completed.

Logbook entries should be dated, legible, and contain accurate and inclusive documentation of an individual's project activities. Because the logbook forms the basis for later written reports, it must contain only facts and observations. Language should be objective, factual, and free of personal feelings or other terminology which might prove inappropriate. Entries made by individuals other than the person to whom the logbook was assigned are dated and signed by the individual making the entry.

Field data reports will be made in bound notebooks, using water-resistant ink, and will include the following:

- o Names and affiliations of personnel on site
- o General description of each day's field activities
- o Documentation of weather conditions during sampling
- o Location of sampling (station number as description)
- o Name and address of field contact (in cover of logbook)
- o Description of accidents involving personnel on site
- o Records of field equipment malfunction and repair
- o Records of site visitations
- o Records of field and lab equipment calibrations
- o Type of sample matrix (e.g., soil, ground water, etc.)
- o Date and time of collection

AR300943

- o Collector's sample identification number(s)
- o Sample distribution (e.g., laboratory, hauler, etc.)
- o Observations of sample or collection environment, if needed
- o Any field measurements made such as pH, flammability, explosivity, etc.
- o Sampler's name
- o Sample type (composite, split, etc.)
- o Source and types of preservatives used

At the end of every sampling day, the Project/Site Manager will collect and store the logbooks in a safe location.

## 6.2 PROJECT SCHEDULING

Figure 6-1 outlines the schedule for Brown's Battery Breaking Site.

AR300944

FIGURE 6-1

## REMEDIAL INVESTIGATION/FEASIBILITY STUDY SCHEDULE

TASK =====	DESCRIPTION =====	START DATE =====	FINISH DATE =====
101-1	Collect/Review Background Data	09/29/88	10/31/88
101-2	Initial Site Investigation	10/28/88	10/28/88
101-3	Scoping Meeting	11/08/88	11/08/88
101-4	Site Access	11/01/88	12/31/88
102-1	Program Integration	12/01/88	02/29/90
102-2	Quality Assurance Audits	11/07/88	02/29/90
102-3	Reporting	10/25/88	03/29/90
103-1	File Closeout	03/16/90	03/29/90
103-2	Closeout Report	03/16/90	03/29/90
201-1	Work Plan Preparation		
	Draft Submittal to EPA	09/29/88	11/29/88
	EPA Review Period	11/29/88	01/18/89
	Revised Draft Submittal to EPA	01/18/89	02/23/89
	EPA Review Period	02/23/89	04/10/89
	Final Submittal to EPA	04/10/89	05/08/89
	Work Plan Approval	05/08/89	05/12/89
201-2	Health and Safety Plan	11/29/88	01/29/89
201-3	Quality Assurance Project Plan		
	Draft Submittal to EPA	11/29/88	02/23/89
	EPA Review Period	02/23/89	04/10/89
	Final Submittal to EPA	04/10/89	05/15/89
	QAPjP Approval	05/15/89	05/22/89
201-4	Sampling and Analysis Plan		
	Draft Submittal to EPA	11/29/88	02/23/89
	EPA Review Period	02/23/89	04/10/89
	Final Submittal to EPA	04/10/89	05/15/89
	Sampling and Analysis Plan Approval	05/15/89	05/22/89
201-5	Subcontract Preparation	11/29/88	05/31/89
202-1	Community Relations Support	03/06/89	03/29/90
203-1	Air Modeling	06/01/89	06/30/89
203-2	Site Inspection	05/22/89	05/23/89
203-3	Soil Sampling	05/22/89	05/31/89
203-4	Surface Water and Sediment Sampling	05/31/89	06/09/89
203-5	Bioassessment Study	05/31/89	06/09/89
203-6	Well Installation	08/07/89	08/11/89
203-7	Ground Water Sampling	08/09/89	08/18/89

AR 200945

FIGURE 6-1

REMEDIAL INVESTIGATION/FEASIBILITY STUDY SCHEDULE  
(continued)

204-1	Sample Analysis	05/22/89	09/08/89
204-2	Analytical Data Validation	06/01/89	10/13/89
205-1	Data Evaluation	06/19/89	10/27/89
206-1	Baseline Risk Assessment	07/05/89	10/27/89
206-2	Public Health Assessment	07/05/89	10/27/89
207-1	Sample Acquisition	05/30/89	06/02/89
207-2	Treatability Studies	07/05/89	08/18/89
208-1	Draft RI Report	10/02/89	11/17/89
	EPA Review Period	11/20/89	12/18/89
208-2	Final RI Report	12/19/89	01/10/90
209-1	Screen Alternatives	11/06/89	12/01/89
210-1	Develop Alternatives	12/04/89	01/12/90
210-2	Cost Evaluation	12/04/89	01/12/90
210-3	Performance Evaluation	12/04/89	01/12/90
211-1	Draft FS Report	01/15/90	02/16/90
	EPA Review Period	02/19/90	03/09/90
211-2	Final FS Report	03/12/90	03/29/90
211-1	Post RI/FS Report	03/30/90	

AR300946

## 7.0 SITE MANAGEMENT

The following sections outline specific functions of site management which are pertinent at the Brown's Site.

The Site Manager (SM)/Project Manager (PM) is responsible for daily oversight of the site crews, including field staff and subcontractor management. All health and safety practices outlined in the Health and Safety Plan (HSP) will be strictly followed.

### 7.1 EQUIPMENT CALIBRATION, OPERATION AND MAINTENANCE

The equipment used in collecting field data during the RI/FS will include a variety of instruments. Proper maintenance, calibration and operation of each instrument will be the responsibility of the assigned field technician. All instruments and equipment used during the studies will be maintained, calibrated and operated according to the manufacturer's guidelines and recommendations. Attachment A of the QAPjP includes copies of available manufacturers guidelines for equipment used on this site. All instruments are inspected and calibrated prior to leaving the office. Instruments are recalibrated at the beginning of each sampling day and more often if indicated by changes in performance or weather conditions which could affect performance. Steel tapes used for well depth measurement will be calibrated twice a year to check for kinks, stretching, or wear.

A routine schedule and record of instrument calibration will be maintained by the QAO throughout the duration of the study.

### 7.2 SAMPLE EQUIPMENT DECONTAMINATION PROCEDURES

All sampling equipment and apparatus will be thoroughly decontaminated prior to use in each sampling event and in between each sampling point to avoid cross contamination. All equipment for soil and water sampling will be washed with a laboratory-grade detergent followed by a rinsing with drinking quality water and a second rinsing with distilled reagent-grade water. Analytical data or manufacturer's certification which verifies the quality of the distilled reagent-grade water will be provided with the analytical results. The equipment used for samples undergoing TCL analyses will be rinsed with pesticide-grade hexane. Ample time will be given for evaporation of solvents and

APR 30 1989

for the equipment to dry prior to reuse. Sampling equipment used to collect samples for organic analysis will not be allowed to come into contact with any type of plastic, such as plastic storage bags. Sampling equipment that is not readily decontaminated will be discarded after each use. Discarded materials, including decontamination solutions, will be accumulated and stored in appropriate receptacles for proper disposal.

### 7.3 SURVEY OF SITE SAMPLING POINTS

The site will require the services of a certified land surveyor prior to the commencement of Phase I soil sampling. The surveyor will set the 100-foot transects/grid stations in the field. On the second site visit, all soil sampling points, and the monitoring wells will be survey located. In addition, the elevations for reference marks on each monitoring well will be established.

### 7.4 CONTAINERIZATION AND ANALYSIS OF INVESTIGATION-DERIVED WASTES

All investigation-derived wastes will be containerized and analyzed to determine whether such materials are hazardous wastes, as defined in federal and State of Pennsylvania regulations. The goal of the containerization and analysis of these wastes is to ensure that materials are disposed of in a proper and legal manner.

The management and location or method of disposal of all investigation-derived wastes will be the responsibility of the EPA, Region III RPM.

Sampling wastes have been divided into the following categories based upon the method of containerization.

#### 7.4.1 Monitoring Well Borehole Cuttings

Borehole cuttings will be generated in the course of drilling and developing monitoring wells during this RI/FS. Cuttings will initially be shoveled into 55-gallon drums at the well head. These drums will be labeled and periodically moved to a temporary storage area. After a container is full, soil samples will be collected from several random locations within the container and composited into one sample for analysis. Soil samples will be analyzed for EP Toxicity.

AR300948

#### 7.4.2 Groundwater from Development of Monitoring Wells

Depending upon the depth of the wells and the hydrogeologic characteristics of the aquifer, a considerable amount of water could be generated during the development of the site monitoring wells. Whenever possible, the 55-gallon drums containing groundwater will be stored near the monitoring well. Final determination of the disposal of this water will be made by the RPM following receipt of the analytic results. Water will be tested for lead by means of SW 3005/SW 7420.

#### 7.4.3 Groundwater from Purging Wells

Groundwater generated by purging wells prior to sampling will be placed in 55-gallon drums. The drums will be labeled and analyzed for the same contaminants as listed above for groundwater analysis.

#### 7.4.4 Decontamination Fluids and Disposal of Protective Clothing and Supplies

All decontamination fluids will be presumed hazardous and will be placed in 55-gallon drums. All disposable protective clothing and supplies will also be presumed hazardous and will be double bagged and placed in separate 55-gallon drums. Drum disposal will be the responsibility of the RPM. All hazardous materials will be disposed in less than 90 days.

AR300949

## 8.0 REFERENCES

1. Extent of Contamination Survey for the Brown's Battery Breakage Site, EPA Region III, November and December 1983.
2. USEPA Federal On-Scene Coordinator's Report, Brown's Battery Breaking Site, Tilden Township, Berks County, PA, Volumes I & II, CERCLA Immediate Removal Action, October 20, 1983 to July 11, 1984.
3. Feasibility Study for Brown's Battery Breaking Site, prepared for EPA Region III by IT Envirosience, December 16, 1983.
4. Phone memo: March 20, 1984 to Gary Galida PADER from Rich Zambito and Kermit Rader regarding Denis Brenan's contention that a permit was required at Brown's Battery.
5. POLREP Inventory as of December 17, 1985 for Brown's Battery Breaking Site.
6. RI/FS Work Plan for Brown's Battery Breaking Site, Final Draft prepared for PADER, Harrisburg, Pennsylvania by Ecology and Environment, January 1986.
7. Letter to Ms. Carol Stokes, CERCLA Enforcement, EPA, from Denis Brennan, Morgan, Lewis and Bockius, Counselors at Law representing General Battery Corporation, regarding an extension of time (July 23, 1986) to respond to RI/FS, June 26, 1986.
8. Letter to Ms. Carol Stokes, CERCLA Enforcement, EPA, from Libby Rhoads, NEPA Compliance Section, regarding National Wildlife Inventory and the recommendation to assess wetland boundaries for the Brown's Battery Breaking Site, June 30, 1986.
9. Letter to Ms. Carol Stokes, CERCLA Enforcement, EPA, from John Bitler, Vice President, Environmental Resources Department, General Battery Corporation (GBC), regarding GBC's participation with other Potentially Responsible Parties (PRP's) in the RI/FS of Brown's Battery Breaking Site, July 25, 1986.

AR300950



BROWN'S BATTERY BREAKING SITE

Section: 8.0  
Revision No.: 0  
Date: 15 May 1989  
Page: 2 of 5

10. Letter to Kermit Rader, Esq., Office of Regional Counsel, EPA, from Frank A. Labor, III, Morgan, Lewis and Bockius, Counselors at Law for General Battery Corporation, regarding the execution of the RI/FS Consent Decree, June 15, 1987.
11. RI/FS Work Plan prepared by Engineering Science for General Battery Corporation, August 10, 1987.
12. Letter to Mr. Jack Kelley, CERCLA Remedial Enforcement Section, from Jeffrey A. Leed, Manager, Wastes Disposal, General Battery Corporation, regarding submission of the Work Plan and Quality Assurance Project Plan for Brown's Battery site, August 11, 1987.
13. RI/FS Quality Assurance Project Plan for Brown's Battery, prepared for General Battery Corporation by Engineering Science, August 1987.
14. Letter to Mr. Jack Kelley, CERCLA Remedial Enforcement Section, from Jeffrey A. Leed, Manager, Wastes Disposal, General Battery Corporation, regarding submission of the RI/FS Health and Safety Plan for Brown's Battery site, October 1, 1987.
15. Trip Report/Site Visit to Brown's Battery Breaking Site, prepared for EPA Region III by Versar, Inc., October 8, 1987.
16. EPA Project Plan Review for Brown's Battery Breaking Site sent to Jack Kelly, Deputy Project Officer, from John Scalera, Chemist, October 23, 1987.
17. RI/FS Work Plan Review for Brown's Battery Breaking Site, prepared for EPA Region III by Versar, Inc., November 6, 1987.
18. Letter to Jeffrey Leed, Manager, Wastes Disposal, General Battery Corporation, from Jack Kelly, Project Officer, PA CERCLA Remedial Enforcement Section, regarding RI/FS comments on Work Plan and Health & Safety Plan, November 10, 1987.
19. Letter to Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, from Ruth Dickinson, Work Assignment Manager, Versar, Inc., regarding printout of Storet water quality data available for U.S.G.S. station immediately North of Brown's Battery Breaking site, November 16, 1987.

AR300951

BROWN'S BATTERY BREAKING SITE

Section: 8.0  
Revision No.: 0  
Date: 15 May 1989  
Page: 3 of 5

20. Revised Report: Review of RI/FS Work Plan, Brown's Battery Breaking Site, prepared for EPA by VERSAR, Inc., November 19, 1987.
22. Letter to Mr. Jack Kelly, CERCLA Remedial Enforcement Section, from Michael Galvin, TES Regional Manager, VERSAR, regarding RI/FS review of Engineering-Science's H & S Plan for Brown's Battery Breaking Site, November 24, 1987.
21. EPA Bioassessment Work Group assessment of the Brown's Battery Breaking Site Work Plan (prepared by Engineering Science for General Battery Corporation, dated August 10, 1987), December 2, 1987.
23. Letter Report Brown's Battery Breaking Site, Health & Safety Plan Review, prepared for EPA Region III by Versar, Inc., December 9, 1987.
24. Letter to Jeffrey A. Leed, Manager, Wastes Disposal, General Battery Corporation, from Jack Kelly, PA CERCLA Remedial Enforcement Section, regarding Health & Safety Comments, December 23, 1987.
25. Letter to Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, from Ruth Dickinson, Work Assignment Manager, Versar, Inc., regarding analysis of metals in soil samples, for Brown's Battery Breaking Site, February 18, 1988.
26. Letter to Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, from Ruth Dickinson, Work Assignment Manager, Versar, Inc., regarding summary of meeting with General Battery/Exide Corporation discussing EPA comments on RI/FS for Brown's Battery Breaking Site, February 24, 1988.
27. Letter to Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, from Ruth Dickinson, Work Assignment Manager, Versar, Inc., regarding analysis of metals in soil samples at Brown's Battery Breaking Site, March 15, 1988.
28. Letter to Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, from Ruth Dickinson, Work Assignment Manager, Versar, Inc., regarding summary of meeting with General Battery/Exide Corporation discussing EPA comments on RI/FS plan, March 15, 1988.

AR300952

## BROWN'S BATTERY BREAKING SITE

Section:

8.0

Revision No.:

0

Date:

15 May 1989

Page:

4 of 5

29. Letter to Jeffrey Leed, Director, Waste Management, Exide Corporation, from Jack Kelly, Project Officer, EPA Remedial Enforcement Section, regarding EPA/Versar summary of RI/FS review held on January 7, 1988, March 25, 1988.
30. Letter to Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, from Jeff Flanzenbaum, Work Assignment Manager, Versar, Inc., regarding an updated parameter table for sampling at Brown's Battery Breaking Site, May 16, 1988.
31. Letter to Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, from Jeff Flanzenbaum, Work Assignment Manager, Versar, Inc., regarding an updated parameter table for sampling at Brown's Battery Breaking Site, June 2, 1988.
32. Letter to Frank Labor, Morgan, Lewis and Bockius, Counselors at Law for General Battery Corporation, from Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, regarding EPA proposed revisions to Consent Order (June 30, 1987) Scope of Work, July 1, 1988.
33. Letter to Jack Kelly, Project Officer, CERCLA Remedial Enforcement Section, from Frank Labor, Morgan, Lewis and Bockius, Counselors at Law for General Battery Corporation, regarding curtailing GBC participation in the RI/FS for Brown's Battery Breaking Site, August 4, 1988.
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AR300953

BROWN'S BATTERY BREAKING SITE

Section:	<u>8.0</u>
Revision No.:	<u>0</u>
Date:	<u>15 May 1989</u>
Page:	<u>5 of 5</u>

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AR300954